

NOTES ON WESTERN AUSTRALIAN *BOSSIAEA* SPECIES
(FABACEAE): 1

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ABSTRACT

Ross, J.H. Notes on Western Australian *Bossiaea* species (Fabaceae): 1. *Muelleria* 8(2): 201-209 (1994). — *Bossiaea aquifolium* Benth. and *B. laidlawiana* Tovey & P.Morris are found to be conspecific. Subspecies *aquifolium* and subsp. *laidlawiana* are recognized within *B. aquifolium*.

BOSSIAEA AQUIFOLIUM BENTH. AND *B. LAIDLAWIANA* TOVEY &
P.MORRIS

Bentham (1864) based his description of *B. aquifolium* on material collected by Drummond (second collection number 130 and unnumbered collections) and on material collected by Clarke from Harvey River. In describing *B. aquifolium*, Bentham was recognizing the glabrous shrub in which the margins of the opposite leaves are pungent-pointed and deeply sinuate that occurs as a common understorey plant in the jarrah (*Eucalyptus marginata* Donn ex Sm.) and marri (*E. calophylla* R.Br. ex Lindl.) forests south of Perth.

Tovey and Morris (1922) described *B. laidlawiana* to accommodate material from the Pemberton and Manjimup area which differed from *B. aquifolium* in having tomentose young stems, differently shaped leaves, calyces and standards and differences in flower colour and size. Tovey and Morris based their description on material collected by Max Koch at Pemberton in October and November 1918 and numbered 2244 and on a collection in MEL without collecting locality or collector. It is clear from Koch's notes which accompany MEL 651289 that he made some effort to collect ample material to demonstrate the distinctness of the taxon. This is borne out by the presence of eleven sheets of Koch material in MEL, four in PERTH, three in NSW and more in other herbaria. Koch drew attention to the large geographical disjunction that separated populations of *B. aquifolium* from the populations of the taxon he was studying near Pemberton and Manjimup.

Since *B. laidlawiana* was described, a large quantity of material has accumulated, much of it collected by my former colleague Margaret Corrick and by Terry Macfarlane of the Western Australian Herbarium. Examination of available collections has revealed that the distinctness of *B. aquifolium* and *B. laidlawiana* is not as absolute as implied by Tovey and Morris; most of the characters used to differentiate *B. laidlawiana* intergrade with *B. aquifolium*. The differential characters employed by Tovey and Morris are considered briefly.

INDUMENTUM

Typical *B. aquifolium* has the young stems and leaves glabrous or almost so and occurs in the Darling Range east of Perth southwards to the Harvey River. From the vicinity of Tallanalla southwards specimens occur, for example Corrick 9733, 9734 (MEL), which resemble typical *B. aquifolium* in every respect except that the young stems are sparingly to densely clothed with hairs. There is a tendency from near Tallanalla southwards to Balingup and south-westwards to Yallingup and north of Margaret River for the degree of pubescence on the young stems to increase. This indumentum varies from appressed antrorse hairs in Corrick 8357, 9733, 9734 (MEL) and Mueller s.n. (MEL 651306), to short curled hairs in Macfarlane 1721 (MEL, PERTH), or a dense cover of short curled hairs

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and longer scattered hairs up to 1 mm long in *J. Forrest s.n.* (MEL 651305). The indumentum sometimes varies on a single shoot; in *Corrick 9734* the extremity of one shoot is quite glabrous whereas the slightly older growth is clothed with appressed antrorse hairs. On some of the densely pubescent specimens the upper and lower surfaces of the leaves, and especially the lower surfaces, bear long spreading hairs, for example, *J. Forrest s.n.* (MEL 651305) from Blackwood River and *R.D. Royce 5114* (PERTH) from Yallingup siding. The range of variation in the indumentum on specimens which agree with material of *B. aquifolium* in all other respects is much greater than implied by Tovey and Morris and there is no discontinuity on the basis of the indumentum between specimens of *B. aquifolium* and those of *B. laidlawiana*.

FLOWERS

Tovey and Morris indicated that their new species differed from *B. aquifolium* in flower size and colour and in the shape of the calyx and standard. I have not noted any significant differences between *B. aquifolium* and *B. laidlawiana* in flower size or in the shape of the calyx or standard. However, flower colour in typical *B. aquifolium* does differ from that in typical *B. laidlawiana* and the flowers of the latter tend to be more sweet-scented.

In typical *B. aquifolium* the standard is deep yellow internally with a dark red or reddish-brown fringe around a basal greenish-yellow throat, and the wings and keel petals are dark red or red-brown. In typical *B. laidlawiana* the standard is a paler yellow internally and the red fringe around the basal greenish-yellow throat is discontinuous, being interrupted in the centre by the yellow throat which extends vertically into the main yellow body of the standard. A small red spot is sometimes present in the centre (in the centrefold of the standard) of the gap in the red fringe. The wings are yellow distally and red basally and the keel petals are red.

The colouration found in typical *B. aquifolium* also occurs in some of the specimens which are fairly densely clothed with appressed pubescence, for example *Corrick 9729* (MEL), from the Glen Mervyn dam. However, the distal portions of the wings in many flowers on the same specimen are orange rather than red.

Examination of material of *B. aquifolium* indicates that flower colour tends to change to the south. The continuous red fringe found on the internal surface of the standard in *B. aquifolium* gradually narrows in the centre until it becomes discontinuous as in the case of *B. laidlawiana*, and this change is accompanied by a change in the colour of the wing petals. Despite the existence of this differential tendency, flower colour does not provide a convincing means of separating the taxa.

LEAF SHAPE

In *B. aquifolium* the leaves are distinctly angular, each angle terminating in a prominent pungent point and the margins are usually distinctly sinuate between the pungent points, especially between the apical point and the nearest lateral point on either side of it. The leaves typically have 5–9 pungent points but some specimens have occasional leaves with as few as 3, for example *Corrick 9376* (MEL), in which case they are almost hastate in shape. Other specimens may have occasional leaves with as many as 13 pungent points, for example *Corrick & Ross 9198* (MEL). Leaf shape in *B. aquifolium* is basically broadly depressed ovate and the leaf base is usually slightly cordate and somewhat truncate. (Fig. 1)

In *B. laidlawiana* the leaves are very broadly ovate to semi-orbicular and are not usually as distinctly angular as in *B. aquifolium*. The apex has a pungent point but the margins tend to have more numerous (12–25) points or teeth and are dentate rather than deeply sinuate and pungent-pointed. Leaf shape often varies quite markedly on a single specimen. The leaf base is often slightly cuneate rather than truncate.

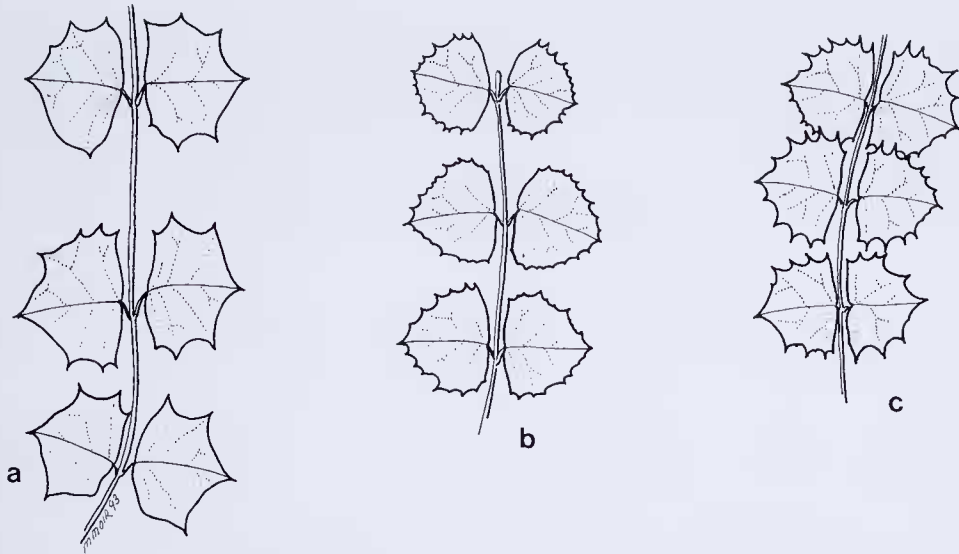


Fig. 1. Leaf shape. a — typical *B. aquifolium*, $\times 1$, from *M.G. Corrick 9199 & J.H. Ross* (MEL); b — typical *B. laidlawiana*, $\times 1$, from *A.C. Beauglehole 12637* (MEL); c — intermediate, $\times 1$, from *M.G. Corrick 9242* (MEL).

Leaf shape permits most specimens to be referred to either one taxon or the other quite readily over the entire range of the two taxa except for an area to the south and south-east of Nannup. In this latter area specimens occur, for example *Corrick 9233, 9242, 10554* (MEL), which are difficult to assign to either taxon with certainty on the basis of leaf shape. The variation in leaf shape appears to be most pronounced along the north-western portion of Davidson Road which links the Vasse Highway south of Nannup and Manjimup.

ECOLOGICAL PREFERENCES

B. aquifolium and *B. laidlawiana* are dominant understorey shrubs or small trees. *B. aquifolium* usually occurs in drier areas in association with *Eucalyptus marginata* and *E. calophylla* whereas *B. laidlawiana* favours moister areas and is usually associated with *E. diversicolor*. However, although each species has slightly different ecological preferences, there is no absolute distinction as *B. laidlawiana* is sometimes associated with *E. marginata* (*Corrick 9239*), with *E. marginata* and *E. calophylla* (*Corrick 9241*) or with even stands of *E. diversicolor*, *E. marginata* and *E. calophylla* (*Macfarlane 2043*).

The material collected since *B. laidlawiana* was described has reduced significantly the size of the geographic discontinuity that was thought by Koch to separate the two taxa.

CONCLUSIONS

As *B. aquifolium* and *B. laidlawiana* grade into one another, and as specimens exist which are difficult to refer to either with confidence, it is inappropriate to continue to recognize the two as distinct species. Given the uniformity of *B. aquifolium* in the northern part of its range on the one hand, and the uniformity of *B. laidlawiana* in the Manjimup-Pemberton area on the other, it is proposed to accord the two taxa subspecific rank on the basis of the differential tendencies exhibited by each and to treat *B. laidlawiana* as a subspecies of *B. aquifolium*.

As each of the characters relied upon by Tovey and Morris to separate the taxa breaks down, it is necessary to assess how the two taxa are best circumscribed and the characters upon which most reliance can be placed. As leaf shape and the degree of pubescence of the young stems is not always necessarily correlated, a

choice must be made between grouping specimens together on the basis of leaf shape regardless of the degree of indumentum of the young stems, or, alternatively, grouping them together on the degree of pubescence of the young stems regardless of leaf shape. The occurrence of a fairly dense indumentum on some specimens that are typical of *B. aquifolium* in all other respects suggests that leaf shape provides a more reliable and meaningful character to differentiate the taxa than does the degree of pubescence. Accordingly, emphasis is placed on leaf shape, together with ecological preferences, in separating the two subspecies.

Bossiaea aquifolium Benth., Fl. Austral. 2: 157 (1864).

SYNTYPES: Western Australia, *J. Drummond 2nd coll. no. 130* (BM, K, MEL, NSW, PERTH); *J. Drummond s.n.* (K, MEL); Harvey River, Western Australia, *W. Clarke s.n.* (K).

Slender shrub or small tree to 8 m high; *branchlets* glabrous or sparingly to densely clothed with appressed antrorse hairs or curled hairs, the latter sometimes with longer spreading hairs up to 1 mm long interspersed, terete, slender. *Leaves* opposite, unifoliolate, lamina depressed ovate or broadly ovate to semi-orbicular, the apex terminating in a pungent point, distinctly angular with each angle terminating in a pungent point and the margins distinctly sinuate between the pungent points or not distinctly angular and the margins dentate, (0.5) 0.8–2.2 cm long, (0.5) 0.8–2 (2.6) cm wide, wider than long, slightly cordate basally, glabrous throughout or with scattered hairs; petiolule 0.9–2.2 mm long, glabrous to densely pubescent. *Stipules* triangular, 0.7–1.8 mm long, 0.5–0.9 mm wide, glabrous to densely pubescent. *Flowers* axillary, solitary or in pairs, shortly pedicellate, the pedicel exceeding the two outer basal bracts; the two inner bracts enclosing the flower buds elliptic, 6–10 mm long, rigid, brown, longitudinally striate, margins conspicuously ciliate especially apically, the outer one cucullate apically, fugacious; the two outer bracts persistent, the outer of the two broadly ovate, 1.4–2.3 mm long, 1.5–2.4 mm wide, longitudinally striate, pubescent basally and with marginal cilia or sometimes sparingly pubescent throughout, the inner bract completely encircling the pedicel, broadly ovate, 1.5–2.4 mm long, 2.3–3.4 mm wide, longitudinally striate, pubescent basally and with marginal cilia; bracteoles absent. *Calyx* glabrous throughout except for marginal cilia or with occasional scattered hairs: 2 upper lobes 4–5.7 mm long including the tube 2.3–4.2 mm long, lobes rounded-truncate and only slightly emarginate apically, 3 lower lobes 0.8–1.5 mm long, 1.3–1.7 mm wide. *Standard* more or less orbicular, 11.8–18 mm long including a basal claw 2–3.2 mm long, 10.8–18.5 mm wide, emarginate apically, yellow or deep yellow internally with a dark red, red or reddish-brown continuous fringe around a basal greenish-yellow throat or the fringe discontinuous, being interrupted by the yellow throat which extends vertically and joins the main body of the yellow standard; *wings* 9.7–13.7 mm long including a claw 2.3–3.3 mm long, auricled, 2.4–4.2 mm wide, dark red or reddish-brown throughout or orange or yellow apically; *keel petals* 10–13 mm long including a claw 2.5–3.2 mm long, auricled, 3.2–4.8 mm wide, red or reddish-brown. *Stamen-filaments* 7.4–11 mm long. *Ovary* 3.5–5.5 mm long, on a stipe 2.6–3.7 mm long, glabrous, 2–4-ovulate. *Pods* stipitate, ovate-oblong to oblong-elliptic, 1.1–2.4 cm long, 0.7–1.1 cm wide, thickened along the upper suture, glabrous. *Seeds* ellipsoid, 3.2–3.5 mm long, 2.1–2.5 mm wide, chocolate-brown, the small hilum covered by a hooded cap-like aril.

DISTRIBUTION

Occurs in the Darling Botanical District of the Southwestern Botanical Province of Western Australia as defined by Beard (1980) from the vicinity of Mundaring east of Perth southwards to near Margaret River and eastwards to Manjimup.

NOTES

B. aquifolium plays a very important role in the ecology of the *Eucalyptus marginata*, *E. diversicolor* and *E. calophylla* forests where it is often a conspicuous element of the understorey. *B. aquifolium* is one of the species referred to as 'fire weeds' (Bell *et al.*, 1989). If seed is present in the soil, the passage of a hot fire stimulates abundant regeneration of fire weeds (Shea *et al.*, 1979). Data from sites in experimental burns near Dwellingup indicated that the numbers of *B. aquifolium* 'were greatly increased following soil heating and still remained more than double the pre-fire level after 5 years' (Bell *et al.*, 1989).

The vernacular name 'water-bush' is used for *B. aquifolium* in a broad sense which is very apt. After rain, water collects in the axils of the opposite leaves and, when the branches are brushed against or bumped in passing, the reward is a shower of water. However, for plants in the Manjimup and Pemberton areas (i.e. subsp. *laidlawiana*), the name 'netic' is used (T.D. Macfarlane, pers. comm.)

The rust fungus *Aecidium eberneum* McAlpine occurs commonly on the green pods of both subspecies of *B. aquifolium* (Shivas, 1989; Macfarlane, pers. comm.).

I am under no illusions about the difficulties involved in attempting to place some specimens. Reliance on vegetative characters to differentiate the two subspecies imposes limitations and it is sometimes difficult to differentiate between a pungent point and a tooth. The placement of some specimens will be somewhat arbitrary. Because of the variation in leaf shape on some individual specimens, it may be helpful when keying out specimens to select leaves that exhibit the mid-point in the range of variation rather than the extremes.

KEY TO SUBSPECIES OF *BOSSIAEA AQUIFOLIUM*

- 1 Leaves distinctly angular, each angle terminating in a pungent point, the margins usually with (3) 5–11 pungent points and usually distinctly sinuate between the points (especially between the apical and the nearest lateral points); branchlets glabrous or sparingly to densely pubescent; associated with *Eucalyptus marginata* and/or *E. calophylla* **subsp. aquifolium**
 1: Leaves not as distinctly angular, the apex with a pungent point but the margins with numerous (11–25) teeth or points and not deeply sinuate; branchlets sparingly to densely pubescent; usually associated with *Eucalyptus diversicolor*, but sometimes with *E. marginata* or *E. calophylla* or even stands of all three species **subsp. laidlawiana**

Bossiaea aquifolium* subsp. *aquifolium

B. aquifolium Benth., Fl Austral. 2: 157 (1864)

Glabrous or sparingly to densely pubescent shrub or small tree; leaves distinctly angular, usually with (3) 5–11 pungent points and the margin usually distinctly sinuate, especially between the apical and nearest lateral points; standard deep yellow or yellow internally with a continuous dark red or red-brown fringe around a basal yellow throat or the fringe discontinuous and interrupted by the yellow throat which extends vertically into the main yellow body of the standard; wings red or reddish-brown throughout or orange or yellow apically.

DISTRIBUTION AND ECOLOGICAL PREFERENCES

Occurs from the vicinity of Mundaring in the Darling Range east of Perth southwards to the vicinity of Margaret River and eastwards to Collie and Nannup. Favours lateritic soils and clay loam. A common understorey species in *Eucalyptus marginata* and *E. calophylla* forest. (Figs. 2 & 3)

REPRESENTATIVE SPECIMENS (62 examined)

Western Australia — Darling Range, Mundaring Weir Road, 5 Oct. 1984, *M.G. Corrick 9199* & *J.H. Ross* (MEL, PERTH); Mt Dale Road, SE of Carinyah, 6 Nov. 1983, *M.G. Corrick 9028* (AD, CBG,

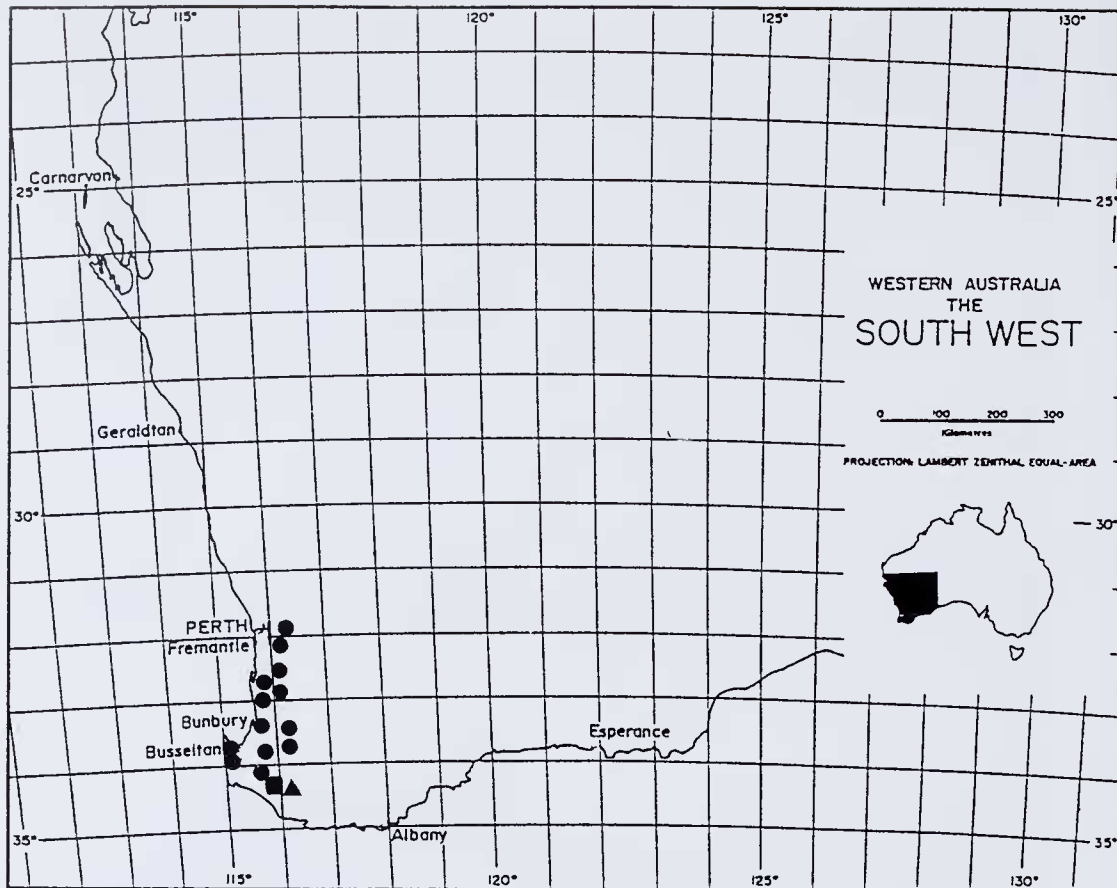


Fig. 2. Distribution of *B. aquifolium* subsp. *aquifolium* (●); *B. aquifolium* subsp. *laidlawiana* (▲); *interzone* (■).

HO, MEL, NSW, PERTH); Coalfields Road, 2 km W of Allanson, 12 Sep. 1979, *J.Koch s.n.* (PERTH); Glen Mervyn Dam, 22 Oct. 1985, *M.G.Corrick 9729* (MEL, PERTH); near Newlands, c. 10 km S of Donnybrook, 4 Oct. 1982, *M.G.Corrick 8342* (MEL); 12 km S of Nannup on Vasse Hwy, 10 Oct. 1984, *M.G.Corrick 9231* (MEL, PERTH).

NOTES

Typical subsp. *aquifolium* with the young stems and leaves glabrous or almost so occurs in the Darling Range east of Perth and southwards to the Harvey River. From the vicinity of Tallanalla southwards to Balingup and south-westwards to Yallingup and north of Margaret River specimens occur which resemble typical subsp. *aquifolium* in every respect except the young stems are sparingly to densely clothed with hairs. These specimens are included in subsp. *aquifolium*.

The specimen *A.N.Rodd 4798* & *G.Fensom* (PERTH) from 10.6 km E of Kelmscott on the Brookton Highway shows unusual variation in leaf shape. Some leaves have the typical angular shape with each angle terminating in a pungent point, others are not angled apart from the apical point, and occasional leaves are almost hemispherical or reniform and lack even the apical point. The latter leaves are reminiscent of those found in *B. webbia* but the margins are not denticulate as in that species.

Bossiaea aquifolium* subsp. *laidlawiana* (Tovey & P. Morris) J.H.Ross, *comb. et stat. nov.

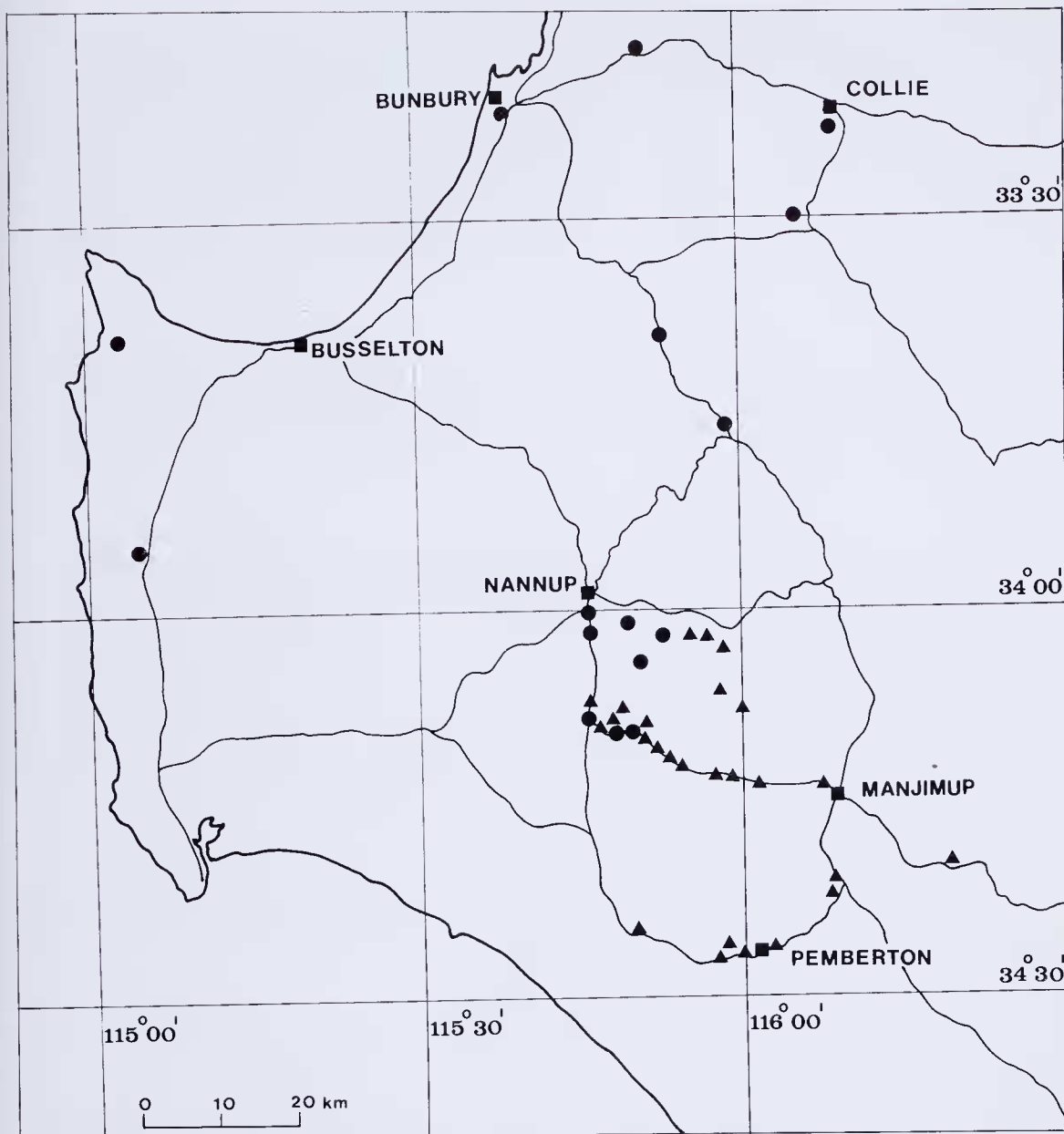


Fig. 3. Distribution of *B. aquifolium* subsp. *aquifolium* (●) and *B. aquifolium* subsp. *laidlawiana* (▲) in the area centred on Nannup where the distributions overlap.

Bossiaea laidlawiana Tovey & P. Morris, Proc. Roy. Soc. Victoria new ser. 34:207 (1922). TYPE: Pemberton (Big Brook), Warren District, Western Australia, Oct.-Nov. 1918, *M. Koch* 2244 (MEL 651289, LECTOTYPE, here chosen; AD, ISOLECTOTYPE.).

Sparingly to densely pubescent shrub or small tree; leaves not as distinctly angular, the apex with a pungent point but the margins with numerous (11–25) teeth or points and not deeply sinuate; standard yellow internally with a discontinuous red fringe around a greenish-yellow throat, the red fringe interrupted by the yellow throat which extends vertically into the main yellow body of the standard, usually with a red spot in the centre (the centrefold of the standard) of the gap in the red fringe; wings yellow apically and red basally.

DISTRIBUTION AND ECOLOGICAL PREFERENCES

Occurs from the vicinity of Nannup south and south-eastwards to Pemberton and just south-east of Manjimup. There is a solitary specimen, *A.R.Fairall 641* (PERTH) collected on 13 Oct. 1962, from the Valley of the Giants, east of Nornalup. This represents a considerable disjunct eastward extension of the range of the species which is thought to be unnatural; it is possible that it may be the result of seed being dispersed by road-making machinery. (Figs. 2 & 3)

Favours clay-loam soils which sometimes contain gravel. Most commonly encountered as an understorey to *Eucalyptus diversicolor*, but sometimes found with *E. marginata* and *E. diversicolor*, with *E. marginata* and *E. calophylla*, or in even stands of all three species.

REPRESENTATIVE SPECIMENS (57 examined)

Western Australia — Davidson's Road (W of Manjimup) near corner of Coronation Road, 10 Oct. 1984, *M.G.Corrick 9239* (MEL, PERTH); Beedelup Falls, Beedelup National Park, 9 Sep. 1965, *A.C.Beauglehole 12637* (MEL); Pemberton, Oct. 1963, *W.Rogerson 83* (PERTH); 12.7 km NE of Pemberton on Vasse Hwy, 14 Oct. 1985, *J.H. Ross 2997* (MEL, PERTH); Muirs Hwy, 0.3 km E of Nyamup turnoff, Oct. 1992, *T.D.Macfarlane 2141* (MEL, PERTH).

TYPIFICATION

Tovey and Morris based their description of *B. laidlawiana* on material collected in the Warren District in October and December 1918 by M. Koch numbered 2244 and on an undated collection in MEL from Western Australia without locality or a collector's name. There are in MEL three sheets (MEL 651289, 651290, 651293) of *Koch 2244* collected in October (flowering material) and December (fruiting material) 1918. In addition, there is an undated collection numbered *Koch 2244* (MEL 651291), a collection numbered 2244 dated October 1921 (MEL 651292), and unnumbered collections dated Jan. 1921 (MEL 651315), July 1921 (MEL 651314), August 1921 (MEL 651312), September 1921 (MEL 651311), October 1921 (MEL 651313), November 1921 (MEL 651310). Koch's numbers are not collecting numbers which explains why number 2244 appears on specimens collected on different dates.

In PERTH there are two sheets numbered *Koch 2244* dated October 1916, an undated sheet numbered 2244, and an undated unnumbered Koch sheet. In K there is a sheet numbered 2244 dated October 1917 and an undated sheet numbered 2244. In NSW there are two sheets numbered 2244 dated October 1916 and an unnumbered sheet dated October 1921.

From the dates of collection given in the protologue, only three of the Koch sheets in MEL (MEL 651289, 651290, 651293) numbered 2244 and the sheet lacking locality and collector (MEL 651309) are regarded as syntypes. A sheet of Koch material numbered 2244 in AD (formerly part of J.M.Black's herbarium and distributed from MEL) labelled 'Pemberton (Big Brook) Warren district, fl. Oct., fr. Dec. 1918' is also a syntype. It is quite likely that at least one of the PERTH sheets and the undated sheet in K represent syntype material but this cannot be proven. I here select *Koch 2244* (MEL 651289), which is accompanied by Koch's notes, from among the syntypes as the lectotype of *B. laidlawiana*.

NOTES

Several specimens from an area south and south-east of Nannup, for example *Corrick 9233, 9242, 10554* (MEL), are difficult to place with certainty. These specimens, and other intermediate specimens, have been referred with some doubt to subsp. *laidlawiana*.

Ashby 2675 (PERTH) from Pemberton has sub-reniform leaves and shows a close superficial resemblance to *B. webbia*. However, the young stems are densely pubescent unlike those of *B. webbia*.

The seasonal variation in nodule production and nitrogen fixation by subsp. *laidlawiana* in *Eucalyptus diversicolor* forest is discussed by Grove & Malajczuk (1992).

ACKNOWLEDGEMENTS

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